

are maintained by the constant impact of meteoric matter. I never ventured an opinion as to the accuracy of this theory; that is a question which may still have to be fought out. But I refer to it as an illustration of the force of genius with which Mayer followed the mechanical theory of heat through all its applications. Whether the meteoric theory be a matter of fact or not, with him abides the honour of proving to demonstration that the light and heat of suns and stars *may* be originated and maintained by the collisions of cold planetary matter."

His services were recognised by election to membership in the French Academy of Sciences and other foreign societies, and two years before his death the King of Württemberg elevated him to the nobility. Mayer received the Copley Medal of the Royal Society in 1871.

### CUR ASTRONOMICAL COLUMN

**TOTAL SOLAR ECLIPSES.**—The eclipse of the sun on July 29, in which the belt of totality traverses the North American continent from Behring's Strait to the Gulf of Mexico, is a return of the eclipse of June 16, 1806, which was observed in the United States by Bowditch and the well-known Spanish astronomer, Ferrer; in this year it was central, with the sun on the meridian in  $65^{\circ} 30' W.$ , and  $42^{\circ} 23' N.$ , and the duration of total eclipse exceeded five minutes. At its next return on June 27, 1824, it was total at apparent noon in  $170^{\circ} 4' W.$ , and  $44^{\circ} 42' N.$ , but the course of the central eclipse was almost entirely an ocean-track. In 1842, on July 8, the total phase passed over the south of Europe, and was observed by a great number of astronomers, amongst them by the Astronomer-Royal at the Superga, near Turin, and by Baily, at Pavia, and Arago, who was stationed at Perpignan, gave a graphic account of the circumstances attending the extinction of sunlight, which has been often quoted. At the ensuing return of the eclipse in 1860, the "Himalaya" expedition was organised, and numerous descriptions of the phenomenon are upon record; one of the best of them is that given before the Royal Society, as the Bakerian Lecture, by Mr. de la Rue. American observers will doubtless render good account of the eclipse in July next. Its last return in the present century will take place on August 9, 1896, when it will be total soon after sunrise in the north of Sweden and Norway, central at apparent noon in  $112^{\circ} 21' E.$  and  $65^{\circ} 38' N.$  between Nova Zemlia and the mainland of Asia, ending in  $179^{\circ} 3' W.$  and  $18^{\circ} 35' N.$  in the North Pacific.

We have already given in this column some particulars of the total phase as it will occur in the present year in the United States. The last total eclipse visible in that country took place on August 7, 1869, and is the subject of detailed description in a very interesting appendix to the *Washington Observations*. The line of totality in the eclipse of January 11, 1880, will just reach American ground before sunset; some fifty miles south of Monterey, in California, the eclipse will be total for about forty seconds, but the sun will be at less than  $2^{\circ}$  altitude, thus affording a similar case to that which some interpreters of Herodotus have supposed to have occurred in the eclipse of Thales at the site of the battle between the Medes and Lydians when "day was suddenly turned into night;" though of course a characteristic of every total eclipse, it does not frequently happen that after a long ocean track the total phase is just landed on the coast of a continent at sunset. But although January, 1880, will witness what is strictly the next total eclipse of the sun on the soil of the United States, it does not appear that there will be one favourably circumstanced for observation until the year 1923, on September 10. As it is possible some readers may be interested in seeing the particulars of this eclipse, in connection with the phenomenon in July next, or as the next following eclipse in which totality can be well observed in

any part of the North American continent, we give elements, &c., here, derived upon a similar system of calculation to what has been applied to other eclipses in these columns.

G.M.T. of conjunction in R.A. 1923, Sept. 10, at 8h. 28m. 42s.

Right Ascension	...	...	168	6	55.4
Moon's hourly motion in R.A.	...	...	34	53.8	
Sun's " " "	...	...	2	14.9	
Moon's declination	...	...	5	38	34.0 N.
Sun's " " "	...	...	5	6	14.5 N.
Moon's hourly motion in decl.	...	...	11	5.1	S.
Sun's " " "	...	...	0	56	8 S.
Moon's horizontal parallax	...	...	59	55.3	
Sun's " " "	...	...		8.8	
Moon's semi-diameter	...	...	16	19.7	
Sun's " " "	...	...	15	53.7	

Hence the central and total eclipse commences at 7h. 15.6m. in long.  $154^{\circ} 38' E.$ , lat.  $48^{\circ} 24' N.$ ; it falls with the sun on the meridian in  $127^{\circ} 54' W.$ , and  $38^{\circ} 5' N.$ , and ends at 10h. 15.7m. in  $63^{\circ} 25' W.$ , and  $13^{\circ} 50' N.$  The following are also points upon the line of central eclipse:—

Long.	Lat.	Zen. Dist.	Long.	Lat.	Zen. Dist.
$120^{\circ} 13' W.$	$34^{\circ} 6' N.$	$31^{\circ} 1'$	$106^{\circ} 12' W.$	$26^{\circ} 22' N.$	$40^{\circ} 7'$
$116^{\circ} 52'$	$32^{\circ} 18'$	$33^{\circ} 1'$	$94^{\circ} 33'$	$20^{\circ} 55'$	$54^{\circ} 9'$
$112^{\circ} 25'$	$29^{\circ} 47'$	$34^{\circ} 7'$	$81^{\circ} 14'$	$16^{\circ} 41'$	$71^{\circ} 1'$

Calculating directly for the first of these positions which is near the N.W. point of the island of Santa Cruz, off the Californian Coast, we find

Totality begins at oh. 46m. 22s. } Local mean times.  
 " ends at oh. 49m. 56s. }

The duration of the total eclipse on this coast will therefore be about  $3\frac{1}{2}$  minutes, with the sun at an altitude of nearly  $60^{\circ}$ .

### GEOGRAPHICAL NOTES

**CHINA.**—Lieut. Gill, R.E., who, a short time back, arrived in British Burmah, after succeeding in traversing China from Shanghai to the Yunnan frontier, has furnished a Rangoon paper with an account of his journey. Lieut. Gill, in the first instance, proceeded, *via* Hankow, to Chung-king, in Szechuen, whence he made a trip to the northwards, visiting the fire-wells of Tsi-liu, at which place are also found brine-wells, from which good salt is made. Mr. Gill made his way to Sung-pao-ting, on the borders of the Koko Nor, and to Liang-ngan-foo, returning by a different route to Chêng-tu. Being joined by Mr. Mesney, the two began their long, perilous, and arduous journey to Burmah overland, in the course of which they passed Bathang, on the borders of Thibet, in about N. lat.  $30^{\circ}$ . Near Bathang ranges were crossed which were some 15,600 feet in height. The most common tree near Bathang is the pine, which in some places was seen in magnificent forests, and many of the trees were found to be about three feet in diameter.

A correspondent of the *North China Herald*, writing from Chefoo, says that a scheme is under consideration for working the coal-mines of the province of Shantung, which is well known to be rich in mineral wealth. Some 120 miles to the west of Chefoo there is a fine level plain, under which at no great depth is a bed of coal twenty feet thick. The natives have from time immemorial been digging holes and getting a little out here and there, but as they have no means of drainage, the pits have filled with water as soon as they reached the good coal. The Chinese Superintendent of Customs at Chefoo, has obtained permission to form a native company to carry out the work, with the aid of modern appliances. The scheme referred to is understood to include a tramway to the port of Chefoo. Another project on a larger scale has been formed under the auspices of

the famous Li Hung-chang, for developing the coal and iron districts to the north-west of Tientsin, in the Chihli province. Should the enterprises we have alluded to be successfully carried out, some hopes may be entertained of a gradual development of the hidden resources of the Chinese Empire.

ANGOLA.—We learn that a young and energetic collector, Mr. Alfred Heath, started on board the *Binfra*, which sailed from Liverpool last Saturday, for the purpose of exploring the interior of Angola, and obtaining objects of natural history. Mr. Heath will stay at Ambriz for a short time, and make collections on the River Loge and on the coast, after which he will proceed inland to Bembe, a place recommended by the late Mr. Monteiro as presenting an excellent field for the naturalist.

#### AN ORGAN-PIANO

WHEN recently in Paris I was shown—I believe at the pianoforte factory of M. Herz—a piano with appliances for producing prolonged sounds like those of an organ, which appeared to me to be based on thoroughly sound scientific principles, and which was so great a success that, although the invention had only been perfected a very few weeks before, the firm were receiving orders for the new instruments much faster than they could execute them. The attempt to combine organ sounds with those of a piano has often before, I believe, been made, but usually, if not always, I am told, by combination with the piano arrangements of real organ appliances, the result being, of course, extreme difficulty in obtaining perfect harmony between notes produced by two such totally distinct methods. In the present instance the organ as well as the piano notes are produced by precisely the same means, the principle consisting in producing the organ or prolonged sound by a succession of extremely rapid blows of a hammer upon the same strings as produce the piano note. It will not be difficult, I think (notwithstanding my want of familiarity with such subjects), to make your readers understand exactly how this is accomplished. They will observe that if the pianist were able, instead of merely holding down a key, to produce upon it an extremely rapid succession of blows, far exceeding in rapidity anything which the finger can possibly effect, a prolonged note would be produced, and especially so if the number of blows given was so great as to be practically inseparable by the ear. Now in the instrument of which I am speaking this object is accomplished by means of a series of additional hammers (one to each string) mounted upon watch-spring levers, all of which are carried by a bar of brass lying across, but above and clear of the strings. To this bar is attached a rocking lever which is set in very rapid motion by means of an apparatus worked easily by a pedal. I was not shown the exact nature of this apparatus, but there are so many forms of small engines worked with immense rapidity by compressed air, any one of which would answer the purpose, that no great importance attaches to this point. The *modus operandi* is simple enough: the pianist works the pedal, and thus sets the transverse bar with its series of hammers into excessively rapid vibration. By holding down any key of the instrument, the string belonging to it is brought within range of its corresponding hammer, and is struck with corresponding rapidity, giving out what sounds at a short distance like one prolonged note, which lasts as long as the pedal is worked and the key is kept down. It is easy to see that by this means it is in the power of the pianist to produce either piano or organ notes at will, and although while standing close to the instrument the mode of production of the note could be detected, at a short distance the effect was precisely that

of combined piano and organ sounds with the immense advantage of absolute concordance and harmony between the two.

E. J. REED

#### THE COMING TOTAL SOLAR ECLIPSE

WE have received from Admiral Rodgers, the Superintendent of the U.S. Naval Observatory, the official circular which we were enabled to anticipate some little time ago. Owing to the endeavours of the American astronomers, the Pennsylvania Railroad Company have made arrangements for a reduced rate of fare to and from the East to Denver, Colorado, which is near the central line. These arrangements refer only to persons going in a private capacity, and not to members of expeditions sent out by foreign Governments.

Upon the order of the Superintendent of the U.S. Naval Observatory, Washington, the Company will furnish transportation to Denver and return *viâ* Pittsburg, Indianapolis, St. Louis, and Kansas City, or *viâ* Pittsburg, Chicago, and Omaha, at the following rates for the round trip:—From New York, 73.00 dols.; from Philadelphia, 71.00 dols.; from Baltimore or Washington, 62.50 dols.

The round trip ticket includes transportation (about 2,000 miles according to route) from New York to Denver and back again to point of starting; or in all, 4,000 miles of travel.

These arrangements allow the journey to Denver to be made by one route, and the return by another. The routes available are—

- No. 1, *viâ* Pittsburg, Chicago, Omaha, Denver.
- No. 2, *viâ* Pittsburg, Chicago, Omaha, Denver.
- No. 3, *viâ* Pittsburg, Chicago, Omaha, Denver. (Different routes from Chicago to Omaha.)
- No. 4, *viâ* Pittsburg, Chicago, Leavenworth, Denver.
- No. 5, *viâ* Pittsburg, Chicago, Atchison, Pueblo, Denver.
- No. 6, *viâ* Pittsburg, Indianapolis, St. Louis, Kansas City, Denver.
- No. 7, *viâ* Pittsburg, Indianapolis, St. Louis, Kansas City, Denver. (Different routes from St. Louis to Kansas City.)
- No. 8, *viâ* Pittsburg, Indianapolis, St. Louis, Kansas City, Pueblo, Denver.
- No. 9, *viâ* Pittsburg, Indianapolis, St. Louis, Kansas City, Pueblo, Denver. (Different routes from Kansas City to Pueblo.)

Those intending to make observations of the eclipse, and desiring to take advantage of the courtesy extended by the Pennsylvania Railroad Company, are requested to notify their intention by letter to the Superintendent of the U. S. Naval Observatory, asking that a letter certifying to their identity be forwarded to their consuls at the port they may select for arrival in the United States. This letter must, upon delivery, be countersigned by the consul of the applicant to prevent mistakes.

The Hon. Secretary of the Treasury has notified the collector of customs of the ports of Boston, Portland, New York, Philadelphia, and Baltimore, of the probable arrival of European observers, who will be identified by exhibiting the above letter, so signed and countersigned, to the collectors named. Orders have been issued to them as follows:—

“Upon the arrival at your port of any of the gentlemen mentioned, you will extend all proper facilities for the speedy delivery to them of the professional instruments in question free of duty and charges.”

On presenting the same letter, so countersigned, to the agent of the Pennsylvania Railroad Company in New York, Philadelphia, Baltimore, or Washington, a round-trip ticket to Denver and return, will be issued to them by the Railroad Company at the rates before named.

From Denver railroad lines extend to points likely to be chosen for observing stations.